

## **Frequently Asked Questions on WWHM (12-27-01)**

Below is a compilation of answers to questions about Western Washington Hydrology Model (WWHM). We will update this from time to time to include more clarifying information about WWHM.

**Q: When does the requirement for using WWHM become effective?**

A: It depends on what permit process or regulation is compelling the use the new Stormwater Management Manual for Western Washington, August 2001 (published and became available on September 27, 2001).

- Projects that require review and approval from National Marine Fisheries Service or US Fish & Wildlife will likely need to use the new manual immediately.
- Projects that require State Fish and Wildlife review and approval (HPAs) will likely need to use the new manual immediately.
- For projects covered under the Nationwide 404 permit, Ecology's 401 certification was based on compliance with the 1992 Manual. When those permits are re-certified, Ecology will require application of the new Manual.
- For projects not covered under the Nationwide permit, Ecology will use the new Manual as the default for 401 certification, unless there are site specific conditions that indicate the provisions of the Manual do not apply or are not sufficient.
- Projects requiring review and approval by a local government will have to comply with local government requirements. Those requirements will vary. For example:
  - Many local governments have adopted the 1992 manual by ordinance. They may not be able to require the use of the new manual until they revise their ordinances.
  - Some local government ordinances adopt 'the 1992 manual or most recent Manual published by the Department of Ecology'. Those local governments may begin using the new Manual for new projects when it is published.
  - The Puget Sound Plan directs local governments in the Puget Sound Basin to adopt the new manual (or an equivalent one) by March 2003.
  - The reissued NPDES Phase I permit will require adoption of the new manual, or an equivalent manual, probably pretty close to March 2003.
  - Jurisdictions covered under the Phase II NPDES permit will also likely be required to adopt the new manual, but that is not certain since the permit isn't even drafted yet (as of December 17, 2001). Those jurisdictions are required to be covered under permit by March 2003, but whether they have to adopt a manual at the time they apply for coverage, or during the permit term has not been determined.
- In most instances, there should be no problem with local approval if the new manual is used, rather than the 1992 manual. The new manual will result in project proposals that are at least as protective as the old manual, except for some redevelopment projects.

**Q: What is the recommended minimum and maximum basin area for the model?**

A: The minimum requirement for engineered flow control facilities is given in the Stormwater Management Manual, Volume I, pages 2-29 and 2-30. In general, flow control facilities may be needed for projects that, within a threshold discharge area, have a total of effective impervious area = or > 10,000 sq ft; or convert 3/4 acres or more of native vegetation to lawn or landscape; or convert 2.5 acres or more of native vegetation to pasture.

The stormwater manual recommends that WWHM not be used for drainage areas greater than one-half sq mile.

**Q: Why WWHM chooses forest as the default predeveloped land cover?**

A: In the absence of any other information, the conditions under which a stream or creek is formed in western Washington is assumed to be forested.

**Q: I have attempted to download WWHM and its associated self-extracting \*.exe files and have had difficulty in doing so. There is some confusion on the correct directory that is to be used for running setup.exe ?**

A: The files that you download from Ecology web site are all self-extracting zipped files. It is best to store them in a separate subdirectory dedicated for your web downloads. Some of these files are ordinary Word documents or Excel spreadsheets that were zipped in order to place them on the web site and to accommodate downloading operations from the web site. You need to unzip the downloaded files before you can get to see the WWHM setup files and other Word or Excel files. These should be done in a directory that is different from the c:/program files/wwhm directory.

1- Once you have downloaded and unzipped wwvm1.exe you will see 3 files (WWHM.CAB; setup.exe; and SETUP.LST).  
2- Then run setup.exe. This will setup WWHM program in the c:/program files/wwhm directory.  
3- Now you need to load a county map (you can only run one county at a time). Double click on the county name that you have downloaded from the web site and choose Unzip. This will load the county map in the default directory c:/program files/wwhm/maps.

You are ready to run WWHM. Just click on wwvm.exe and it should start. If and when we make updates to WWHM we will post a self-extracting patch such as an earlier file named "WWHMpatch9-15.exe". Close your WWHM program and double click on the latest patch file and choose Unzip. This will automatically update your wwvm.exe. Run WWHM.exe and it will run the updated program.

**Q: After running the setup I run the program and I get an error 17 ?**

A: This error usually mean that WWHM can't find information about the county map. After running setup you should double click on a county file (e.g., "thurston.exe") and unzip the map for that county. Then you should be able to click on WWHM.exe and run the program. You can only work on one county at a time.

**Q: How do I direct the model to a different county?**

A: You may choose a new county by downloading the county.exe from the Ecology web site and double-clicking and unzipping it in the default "c:/program files/wwhm/maps" directory.

**Q: How are type D soils to be addressed? WWHM user's manual has only type C soils for the predeveloped condition where as WWHM program shows both C and D soils for predeveloped condition. Which one is correct?**

A: The user's manual was printed earlier and we made the change in WWHM (combined types C/D soils) afterwards. So, if you have type D soil, you may use C/D category.

**Q: In Step 2, there is a saturated soil category for the Predeveloped acres but none for the post-developed acres. What happens to the saturated area in the post developed acres ?**

A: WWHM assumes the saturated area is wetland and that there will be no development on it. WWHM checks to see if the total predeveloped acres for the A/B and C/D soil categories is equal to the acres for the A/B and C/D soil categories in the post-developed condition. Although it is not explicitly shown, WWHM internally adds (carries) the saturated area in the Predeveloped condition to the post-developed condition.

**Q: How large a runoff from an Offsite Inflow should be allowed to go through the detention facility.**

A: There is a requirement in Volume 3 chapter 3 of the stormwater manual that limits how large your offsite inflow can be. I have copied it below:

Offsite Inflow: an upslope area outside the development drains to the flow control facility in the development. If the existing 100-year peak flow rate from any upstream offsite area is greater than 50% of the 100-year developed peak flow rate (undetained) for the project site, then the runoff from the offsite area must not flow to the onsite flow control facility. The bypass of offsite runoff must be designed so as to achieve the following:

1. Any existing contribution of flows to an onsite wetland must be maintained, and
2. Offsite flows that are naturally attenuated by the project site under predeveloped conditions must remain attenuated, either by natural means or by providing additional onsite detention so that peak flows do not increase.

**Q: Once I had a pond that passed, i.e. all time intervals "Pass" in "View Duration Analysis", I still got a "This Stormwater Facility: Fails". I was troubled by the result, so I ran through the steps again and the next time I again had all "Pass" in the "View Duration Analysis", but the screen on Step 8 now read "This Stormwater Facility: Passes/Fails."**

A: If you got passes shown in the duration table then the statement is wrong and must be ignored. We had this happening before and there seems to be a problem with the programming algorithm that determines the result of this statement. However, the real proof is in the table against each flow duration.

**Q: The printed report doesn't match the input for step 2 ?**

A: A discrepancy between the report and actual project information may arise, as a result of bugs in WWHM. This discrepancy is being resolved and an updated WWHM program will be posted to the Ecology web site soon. (The last update to WWHM was made on September 15, 2001 using a patch named "WWHMpatch9-15.exe").

**Q: Can you export time series files from WWHM and then use KCRTS to size flow control facilities?**

A: Due to workload and availability of staff, King County didn't want WWHM time series files to be imported into KCRTS. So, unless you know the format for data entry to KCRTS, you wouldn't be able to use KCRTS. Currently, you can export the time series files and may use a commercial software by Engenious Systems, Inc. (an evaluation/beta version is available).

**Q: While there is a way to "export time series" I do not see anything that works to print out the results (in \*.flo files) in a way that can be understood by an ordinary human.**

A: For rain gages with 50 years of hourly data, there are about 440,000 hourly flow data in every runoff time series file. The \*.flo files are formatted as such to help with handling and management of the large amount of data that are used and/or generated by HSPF. There is no column headings in the \*.flo files. Below I have put spaces to separate different columns. Knowing where a data column begins and ends, it may be possible to write a program to tabulate the data in a \*.flo file and generate a readable print out.

Yr	Mo	Day	Half-Day AM=1, PM=2	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr
48	10	1	1	0	0	0	0	0	0	0	0	0	0	0	0
48	10	1	2	0	0	0	0	0	0	0	0	0	0	0	0
48	10	2	1	0	0	0	0	0	0	0	0	0	0	0	0
48	10	2	2	0	0	0	0	0	0	0	0	0	0	0	0

**Q: What are the steps for sizing ponds using the Excel Spreadsheet?**

A: When the duration curve for the post developed w/ pond is to the right of the predeveloped curve, then in general, the area between the curves represents the storage volume that you need to add to your pond. On the other hand, when the post-dev curve is to the left of the pre-dev curve, the area between the curves represents the extra storage volume which you don't need and can get rid of it. When the two curves cross and the area between the two duration curves on both sides are about similar, then your pond size/volume is near its final size and you may start adjusting orifices to get all parts of the post dev w/pond curve to the left of the pre-dev curve. Below are some suggestions on sizing the orifices:

1- Keep the max discharge from the first orifice at half of the 2-year pre-developed flow frequency. Cell E7 of the spreadsheet calculates the max discharge out of orifice 1 as you change the its orifice in cell B7.

2- Once you find the 1st orifice diameter that discharges at a max of half of the 2-year pre-dev out of orifice 1 (cell E7), then make adjustments to the second orifice diameter (B8) until the post-dev curve at the bottom right end of the graph moves to the left of the pre-dev curve. As a general guide: (a)- Place the 2nd orifice height about 2/3<sup>rd</sup> of the pond depth (riser height); (b)- Also, for the 2nd orifice diameter, try to adjust the 2nd orifice diameter in B8 such that the max pond discharge in Cell E8 is about half-way between the 2-year and 5-year pre-dev flow frequencies.

3- If you need a 3rd orifice, then as your first estimate, adjust its diameter in cell B9 such that the pond max discharge in cell E9 is about the 50-year pre-dev flow frequency.

In above suggestions, once you have make a preliminary determination of the orifice sizes in 1-3, run WWHM and generate the duration graph. Then, try to make adjustments to the pond size to make sure that you have a near final pond volume before making additional adjustments to the orifices. After that, try not to adjust the first orifice diameter once it is at 50% of the 2-year. If you need to get the post-dev curve to the left of the pre-dev curve at the bottom right end of the graph, adjust the 2nd orifice diameter. Make adjustments to the 3rd orifice to fix the upper (top left) part of the curve.

**Q: What adjustments should be made to the F\_Table generated by the Excel spreadsheet for underground vaults ?**

A: In the F-Table, the surface area for underground vaults should be set to zero or close to zero. This will avoid error associated with the vault surface area in WWHM. The surface area in the F\_Table is used by WWHM to calculate evaporation as well as runoff associated with the vault. You can artificially set all surface areas in column B of the "FTable Units" sheet and save and use this spreadsheet for underground vaults only.

**Q: On page 32 of the WWHM manual, an example is shown where the 10% tolerance is measured vertically (based on discharge not exceedance). However, Western Washington Stormwater manual states that the 10% is based on exceedance (not flow) and would be measured horizontally on the duration graph. Which tolerance is correct and which criterion does WWHM use when computing compliance with the duration standard?**

A: Page 32 of WWHM manual is an example page copied from KCRTS manual. It is intended to show tips for making adjustments to the orifices. The text box on tolerance is a KCRTS criterion and is different from the state criteria. The stormwater manual sets the tolerance criteria and it is based on the number of times flows exceed the predeveloped flow durations. The state criteria can be found on page B-12, Vol 3, SW Manual for western Washington August 2001.

**Q: Why WWHM does not allow adjustment of site slope ?**

A: A moderate slope has been chosen as the default. HSPF parameters have been calibrated for three degrees of slopes: Flat (0-5%); Moderate(5-15%); and Steep(greater than 15%). The default WWHM slope is moderate. This slope should not be adjusted on a project by project basis, unless it is done as part of the model calibration for a watershed.

For the purpose of designing a detention facility using a continuous model to match flow duration standard, the facility size will not be very sensitive to the site slope or time of concentration as it would be using SBUH to match peak flow standard.

**Q: Could WWHM be used for sizing hydraulic structures ? Why King County's KCRTS can be used for sizing hydraulic structures ?**

A: When sizing a hydraulic structure for conveyance purposes, the projects site slope and time of concentration become important, especially for smaller project sites. In general, time of concentration for small projects are within a few minutes. WWHM uses 40-50 years of hourly precipitation to generate hourly runoff values (including the calculated flow frequencies). These may not be appropriate for designing hydraulic structures that are sensitive to shorter time intervals. For sizing conveyance structures, SBUH or rational method is recommended.

King County manual recommends using the KCRTS continuous model result for sizing hydraulic structures if a project size is 10 acres or greater. For smaller than 10 acres, the King County manual recommends using SBUH or rational method for sizing hydraulic structures. In addition, KCRTS continuous model can generate runoff time series in 15-minutes time interval using some assumed rainfall disaggregation patterns for converting the hourly rain data into 15-minute intervals.